Nordic Energy Technology Perspectives

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Nordic Energy Technology Perspectives

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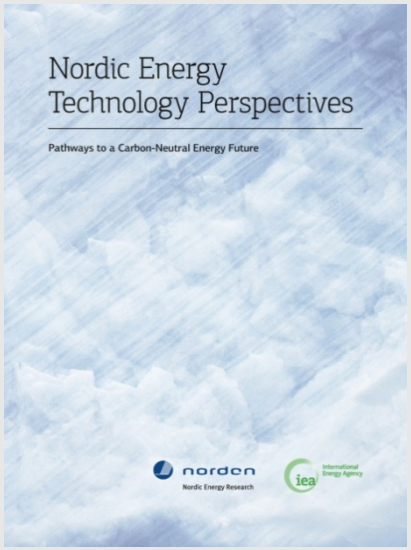
Agenda

- NETP 2013 - Pathways to a Carbon Neutral Energy Future
- Challenges
- NETP 2016 - preliminary work and work plan

ETP vs NETP and Project participants



Project management

Working Group

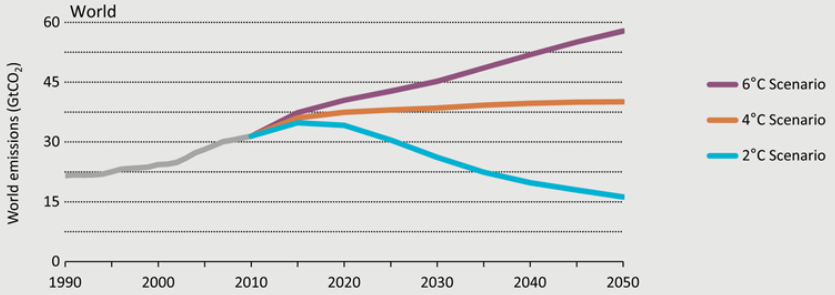
Reference Group

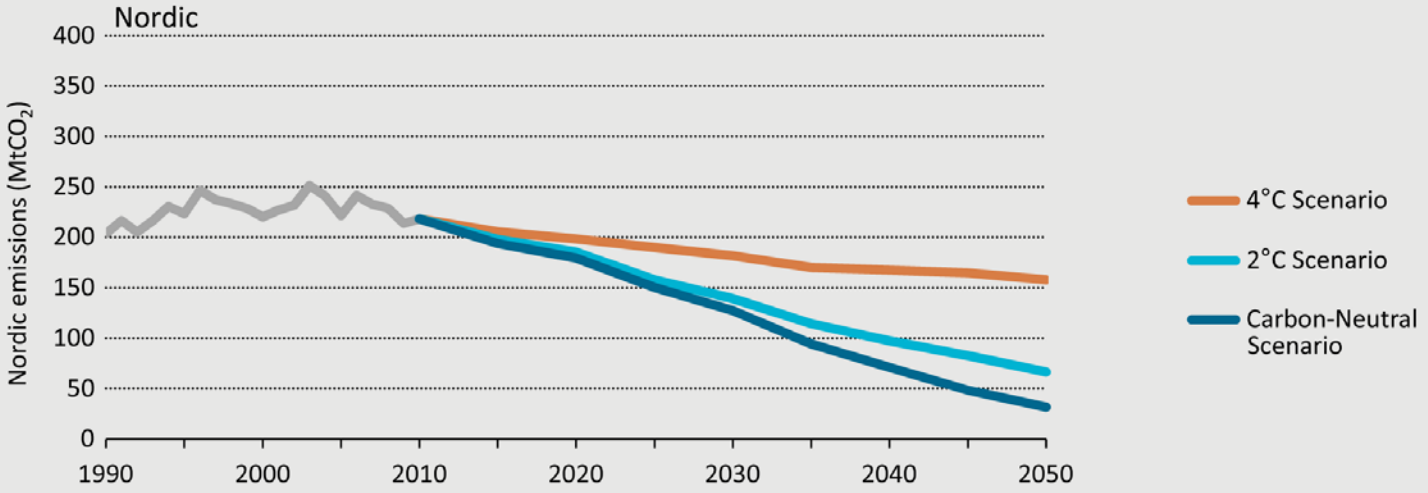
from *ETP* to *NETP:*

ETP and WEO underpin international energy policy dialogue.
But the Nordics were not visible, part of aggregated OECD europe.

NETP combines the global comparibility of the IEA's assumptions with detailed analysis and applicability for the Nordic energy systems.

Global vs Nordic energy-related CO_2 emissions

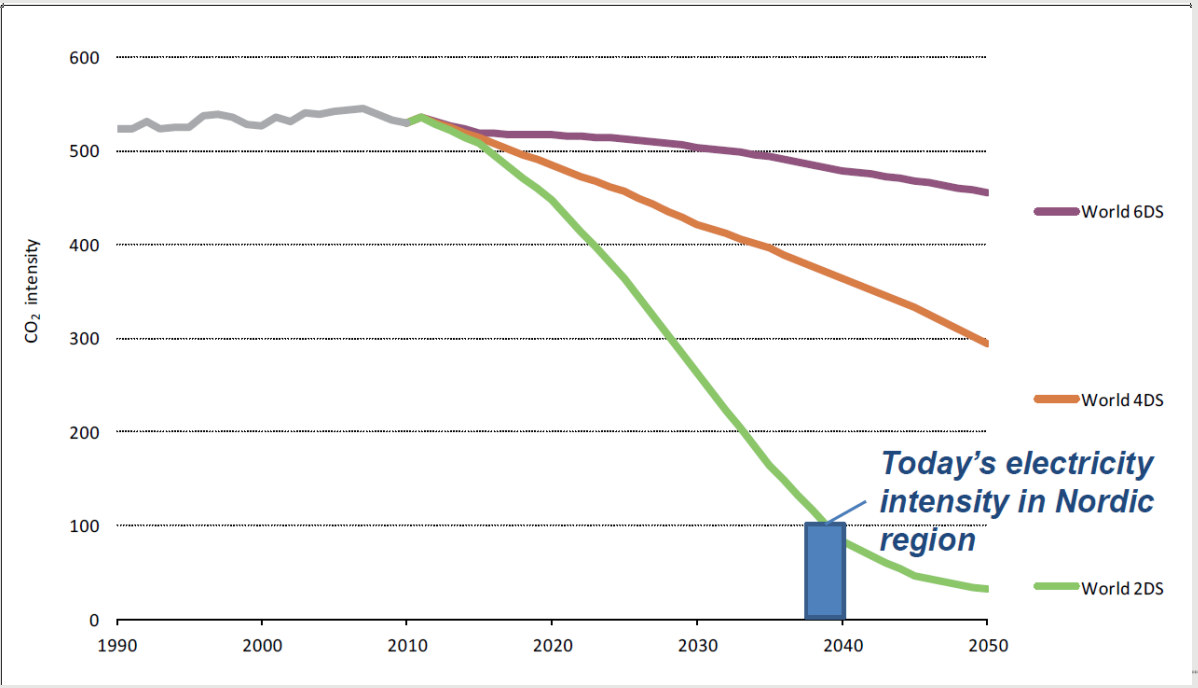


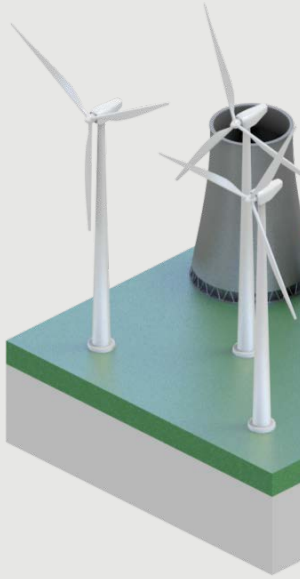


Carbon-neutral scenario (CNS):

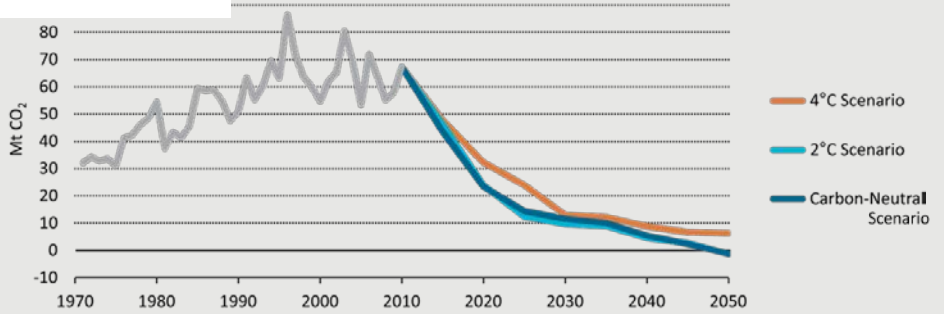
85% reduction of (energy- and process related) CO_2 emissions by 2050 relative to 1990

Nordic electricity system 30 years ahead in terms of CO_2 intensity





Nordic CO_2 emissions from electricity and heat generation

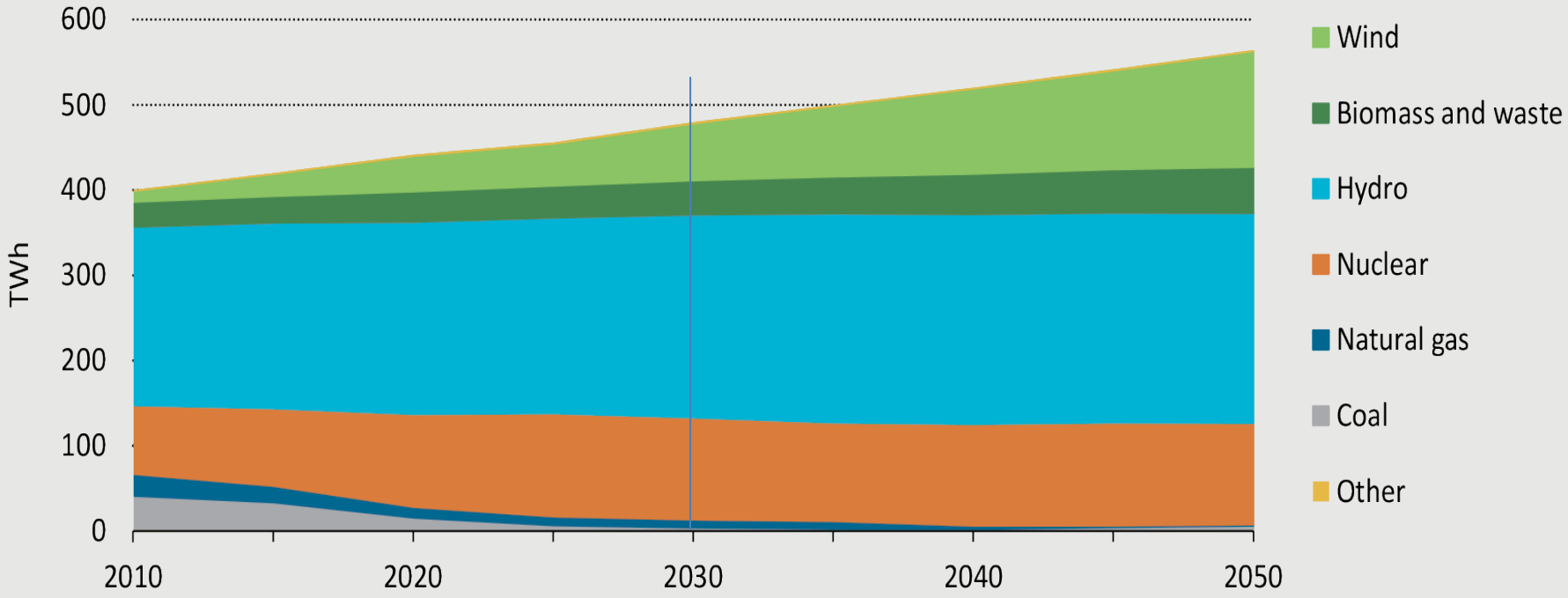


Nordic electricity generation in the Carbon-Neutral Scenario

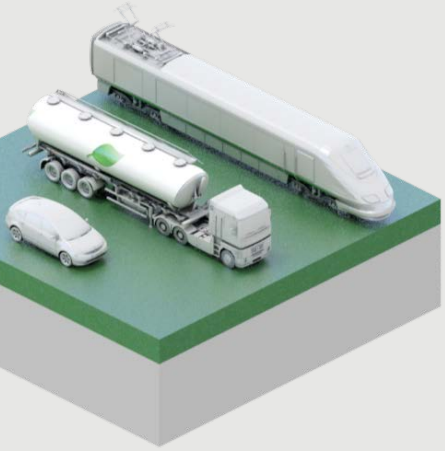
63% RES-E
83% CO_2 free

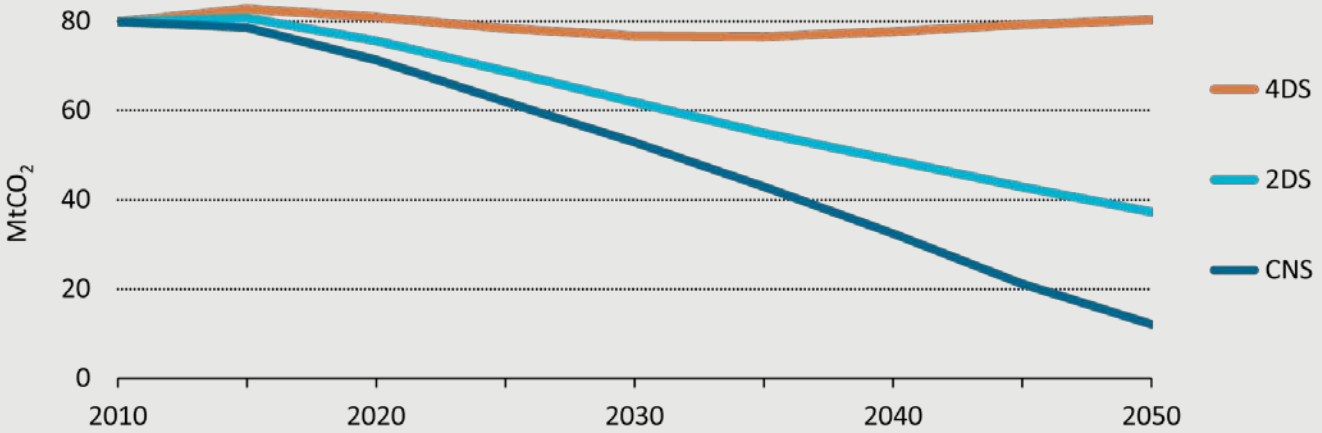
72% RES-E
97% CO_2 free

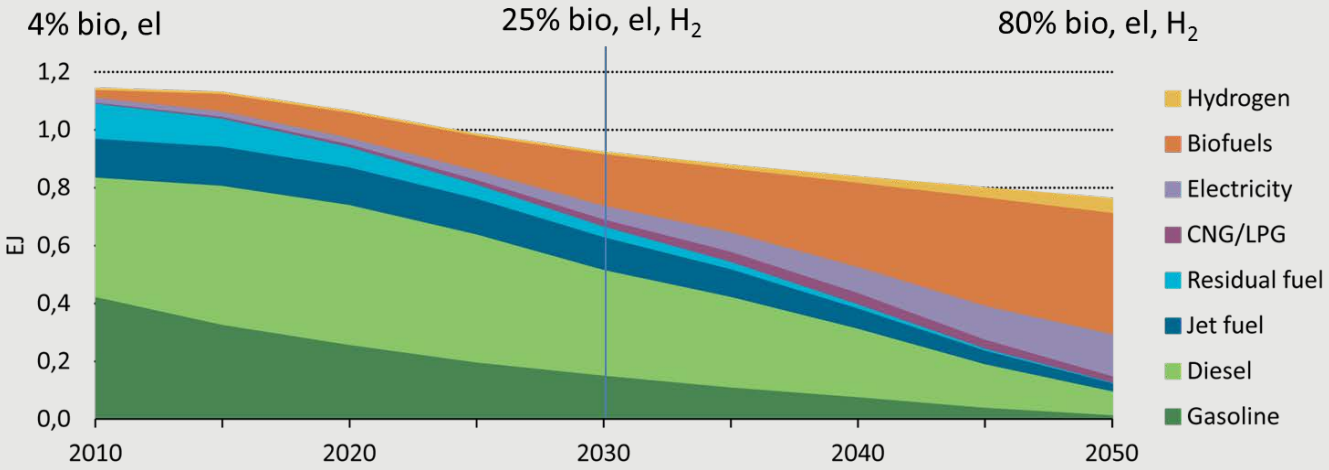
78% RES-E
98% CO_2 free



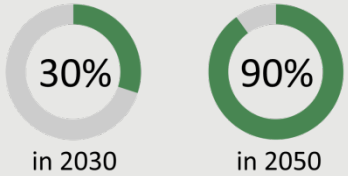
Nordic transport: CO_2 emissions & energy use







EV share of total Nordic car sales



Nordic Energy Technology Perspectives

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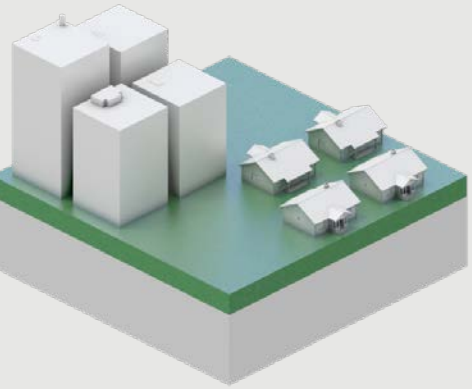
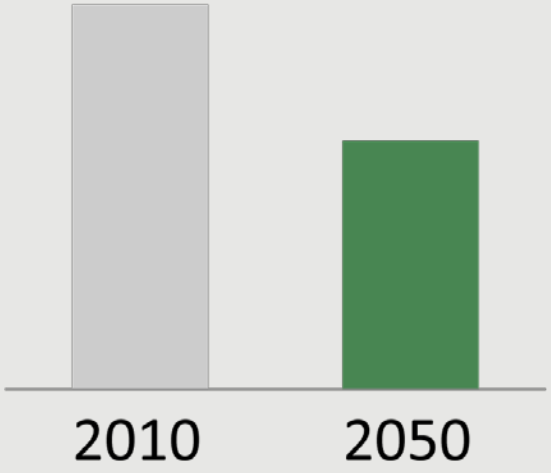
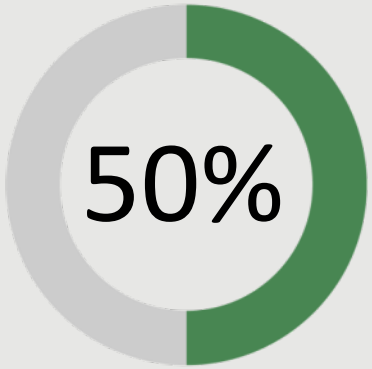
Buildings: Energy efficiency improvements in the Carbon-Neutral Scenario



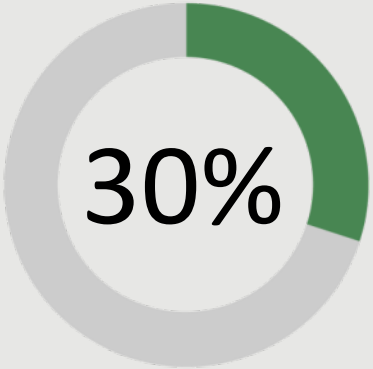


35% drop in residential energy use per m^2

CCS utilisation in industry in 2050

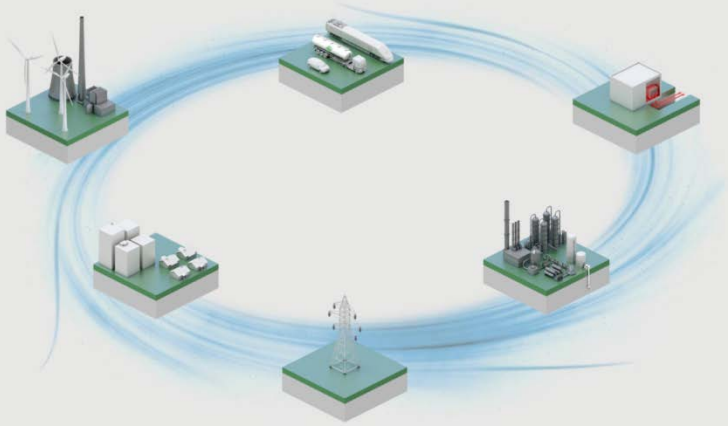


of cement plants

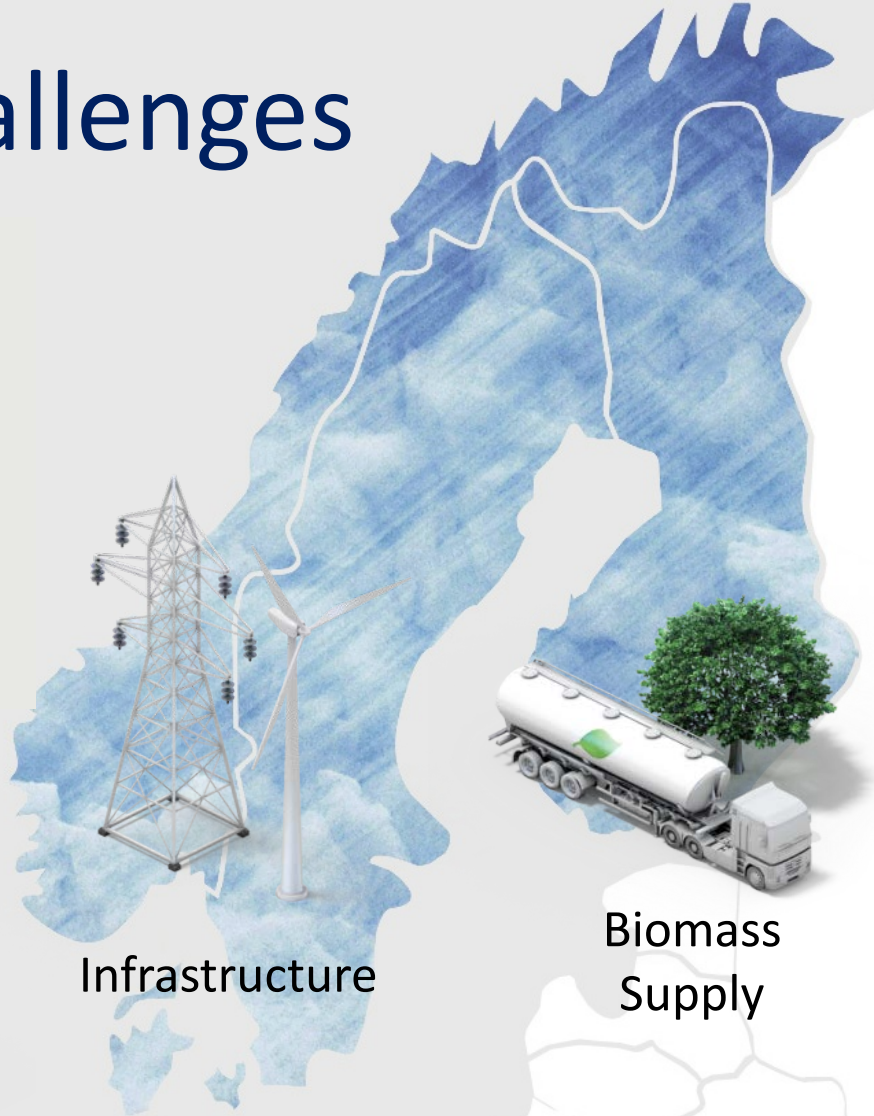


of iron & steel, chemical plants

Key challenges



Electricity system integration



Infrastructure

Biomass Supply

Energy Efficiency

CCS

What's new in NETP 2016?

Narrower scope with more detail

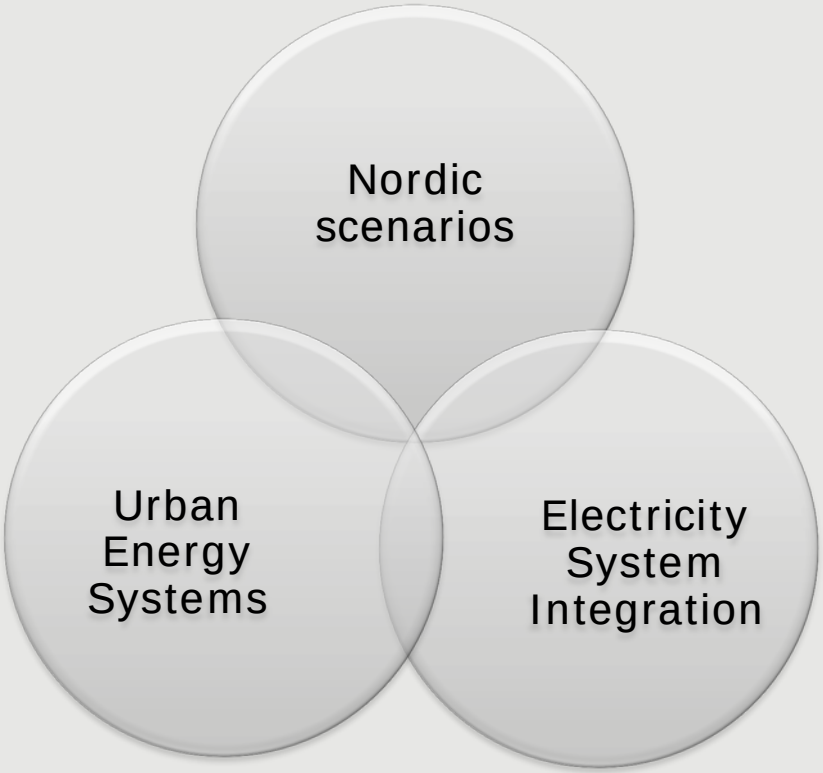
Stronger analytical role for Nordic Institutions

Clearer policy guidance

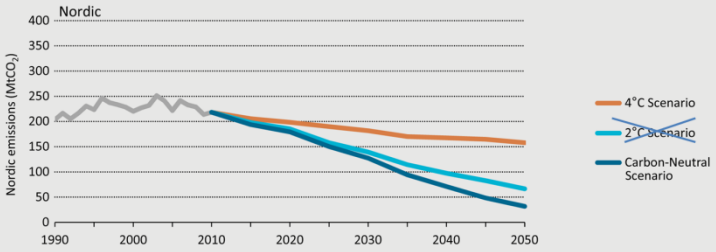
A carbon neutral scenario is possible but challenging:

NETP2013 showed that CNS is possible to achieve; NETP2016 will explain how it can be done.

NETP2016 has three main elements



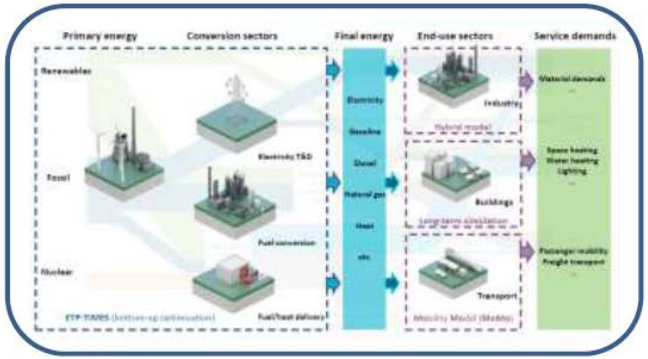
Tight link to ETP2016



No 2DS for Nordic region

NETP 2016: Linkage of ETP model with in-depth analyses

Updated Nordic Scenario Analysis



Capacity mix, Electricity trade, Integration of wind, …

Urban indicators Local supply potentials,…

Electricity System Integration

Urban Energy Systems

Modelling tool

Balmorel model

- Power and district heating
- Programmed in GAMS
- Least cost optimisation based on framework conditions

Optimises

- Dispatch of power plants
- Investments
  - Generation capacity
  - Transmission capacity
  - Storage

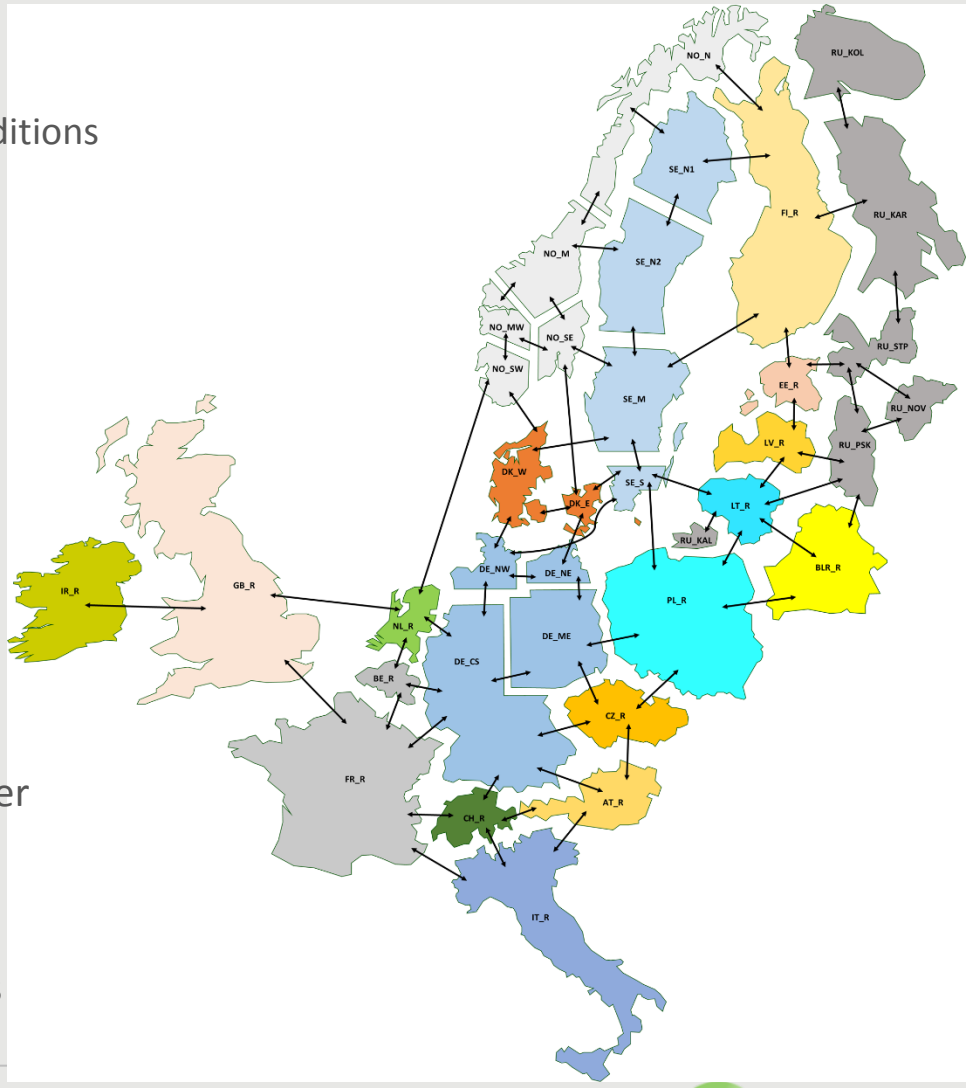
Geographical scope

- Nordics and Baltic sea region
  + third countries

Analyses

How to integrate RES efficiently in the Nordic Power System

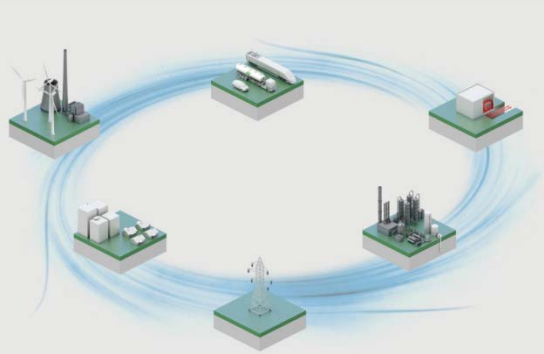
- Cost efficiently
- Securing supply
- Price effects / distribution of cost and benefits
- Urban solutions



Research Frame Integration

Options for integration

- Flexible generation
- District heating, heat pumps
- Bio-fuel, hydrogen production (electricity, surplus heat)
- Demand response (Industry, individual consumers, EV smart charging)
- Storage (pumped hydro, heat, H_2, gas)
- inter-connecters



Analysing integration options

- Quantitative analyses / Model runs

Market design & Policies (short and long term policies)

- Adequate incentives
- Correlated markets (electricity, green certificates, CO_2-quotas, etc.)
- Harmonised or coherent but different national policies?
- How to secure investments

Example: Quantitative analysis

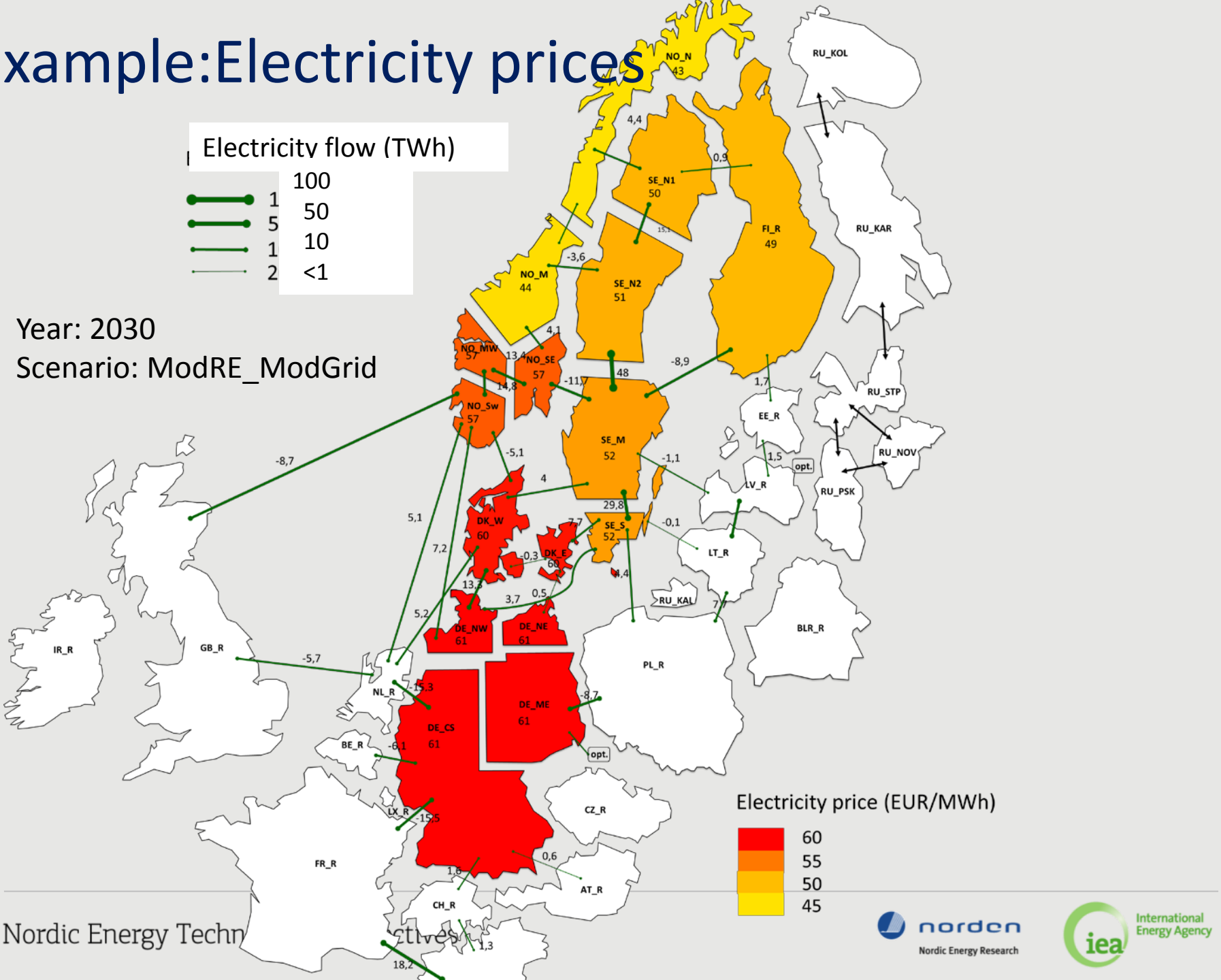
Value of inter-connectors in the Nordic countries

- CNS with/without planned expansion
- "Optimal" expansion

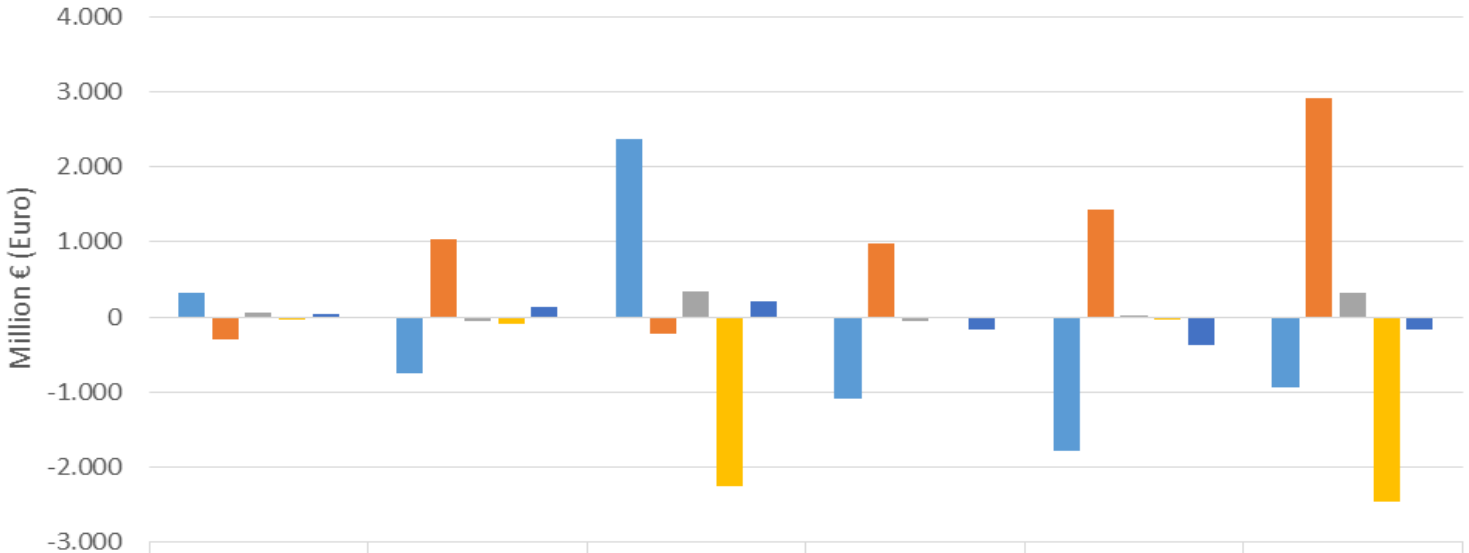
Sensitivity

- nuclear share
- biomass constraint
- Industry/CCS development

Example:Electricity prices



Example: Socioeconomic benefit by country of RE subsidy

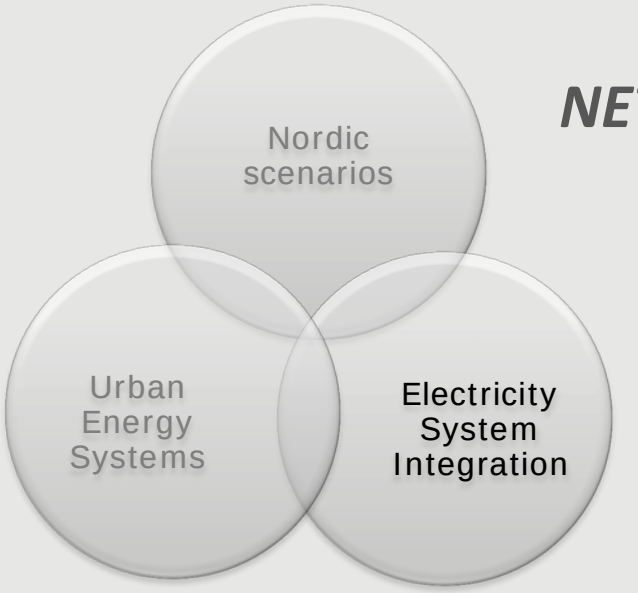


	DENMARK	FINLAND	GERMANY	NORWAY	SWEDEN	TOTAL
Generator profits:	327	-758	2.369	-1.093	-1.792	-948
Consumer surplus:	-308	1.043	-226	983	1.431	2.922
TSO profit:	60	-48	335	-56	22	313
Public profit:	-41	-101	-2.263	-12	-40	-2.458
Total Socio economic benefit:	37	135	215	-178	-379	-170

Summing up

NETP2013 showed that CNS is possible to achieve but challenging;

NETP2016 will explain how it can be done.



The Nordic power market is well functioning despite a few technical challenges

Ground pillar for designs of power markets worldwide.

NETP will give the Nordic countries the opportunity to once more take the lead by showing how to facilitate a sustainable green transition

NETP 2016 workplan

June 2015: preliminary study (draft results and chapter outline)

August/September 2015 - final input from urban & integration study

Preliminary results December 2015,

External review process January 2016,

Launch of report May 2016

www.nordicetp.org

Thank you for your interest

Questions ?

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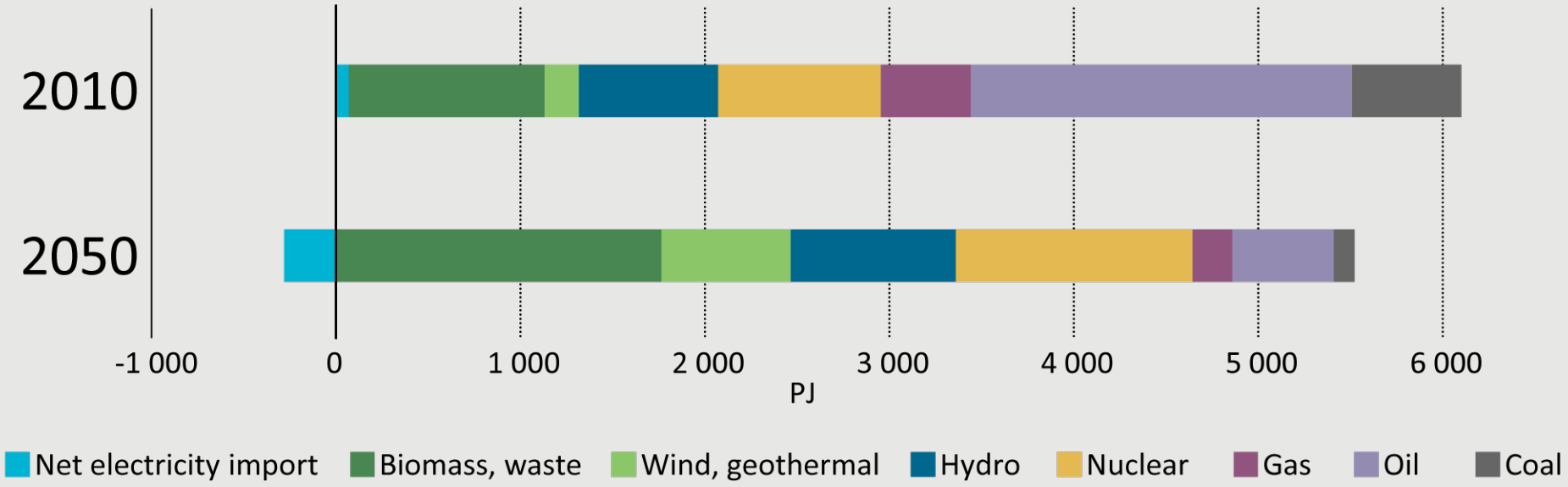
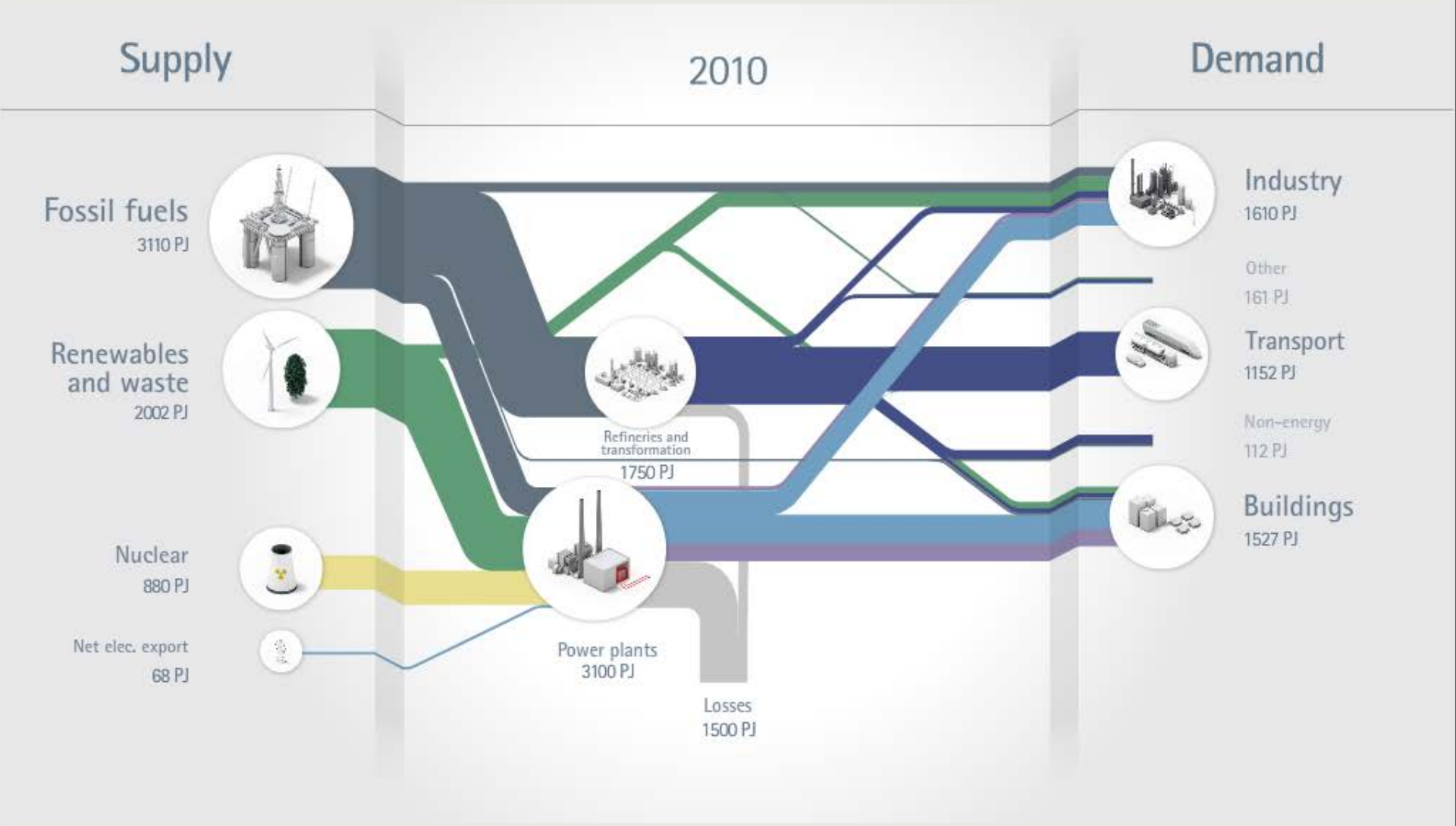
Appendix

Nordic total primary energy supply



Nordic energy flows



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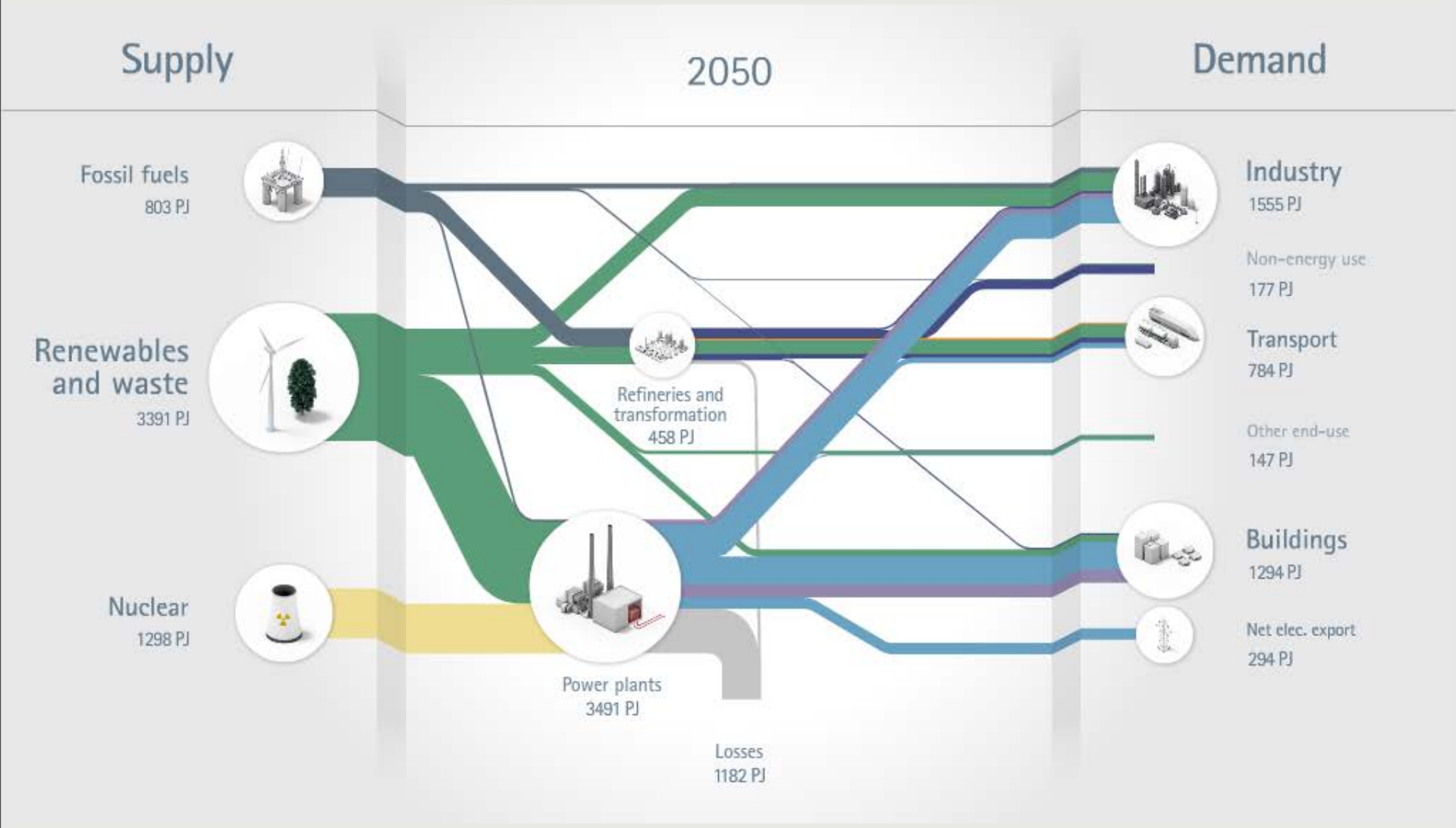
Nordic energy flows



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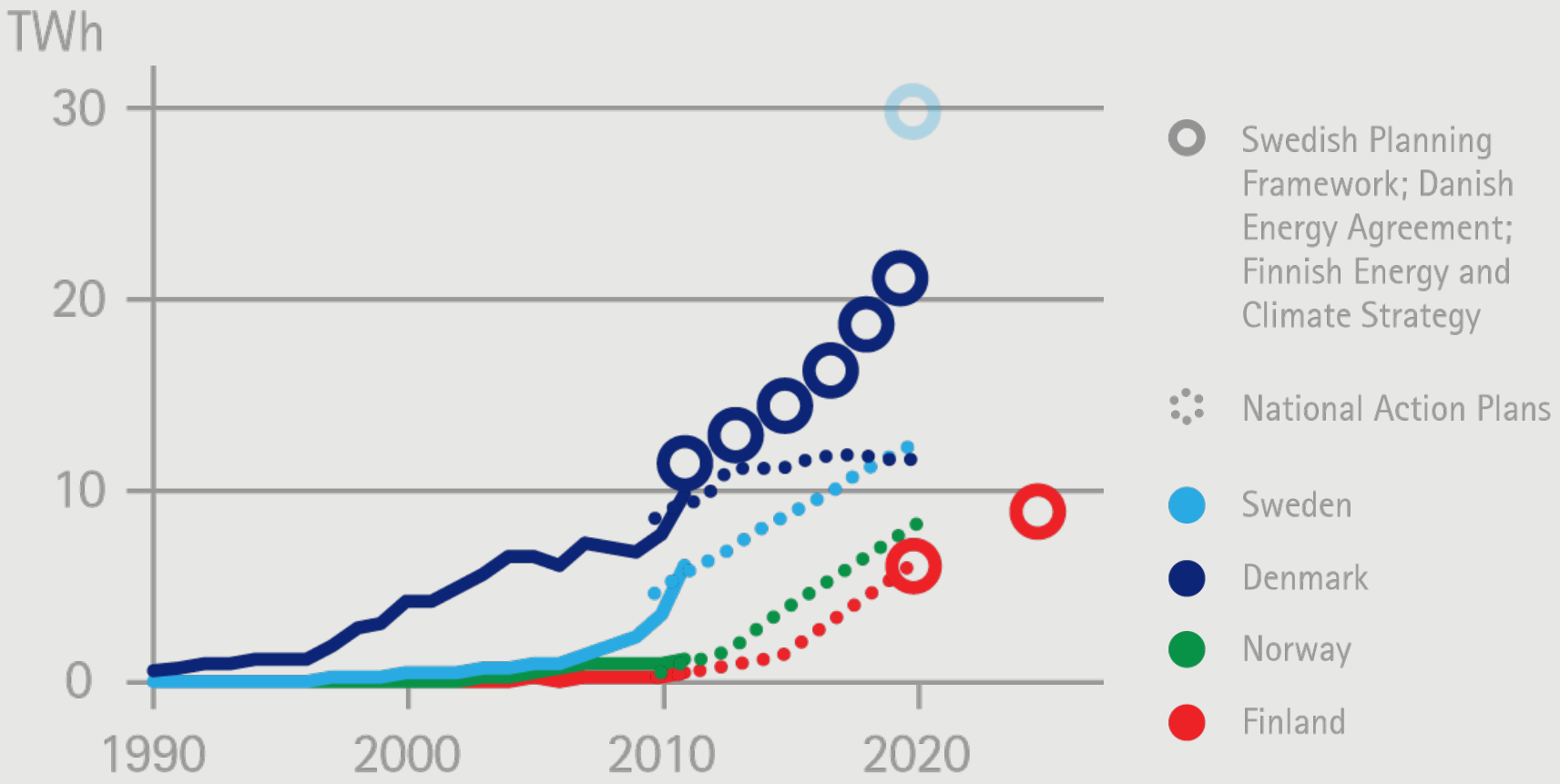
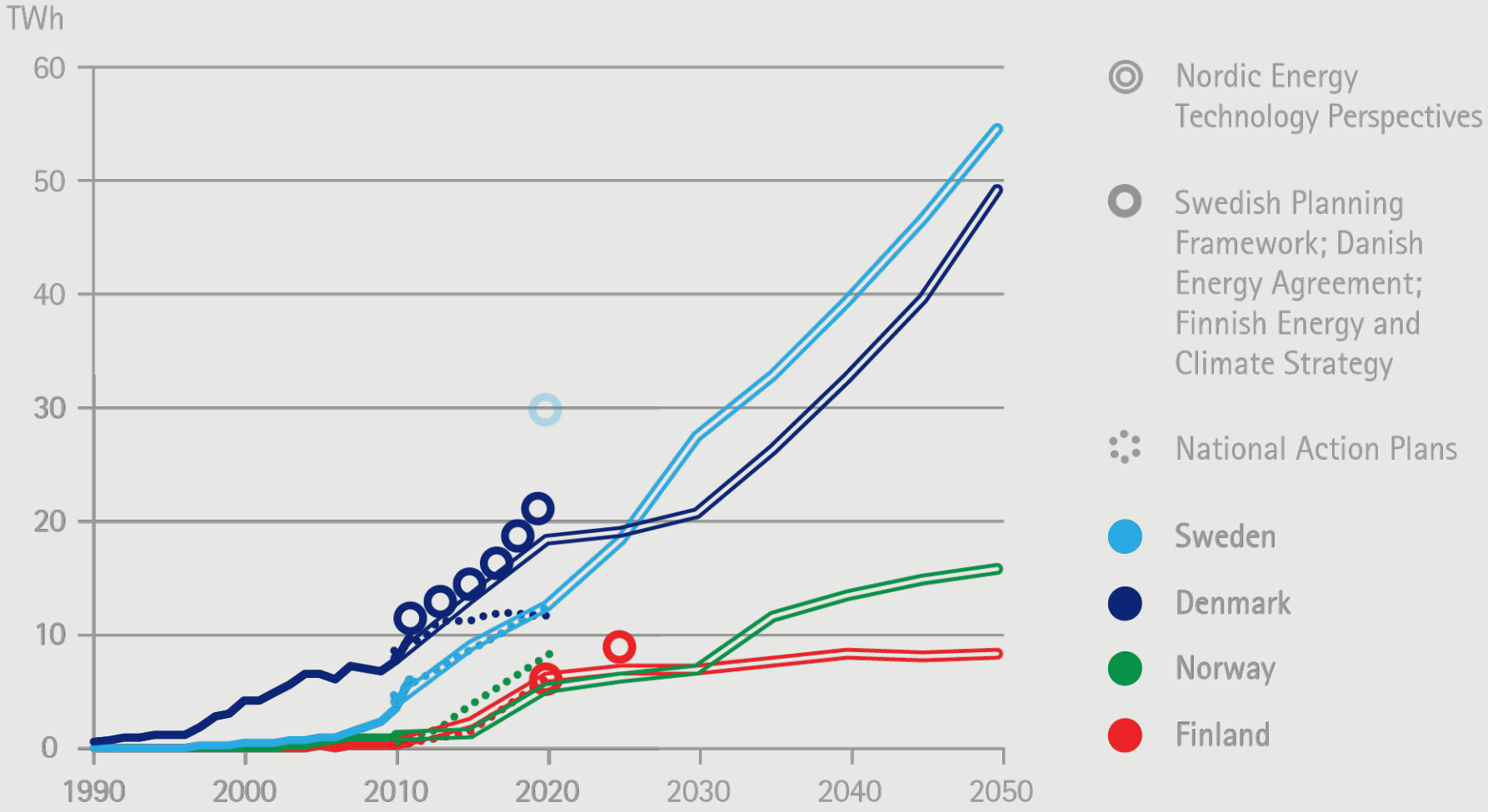
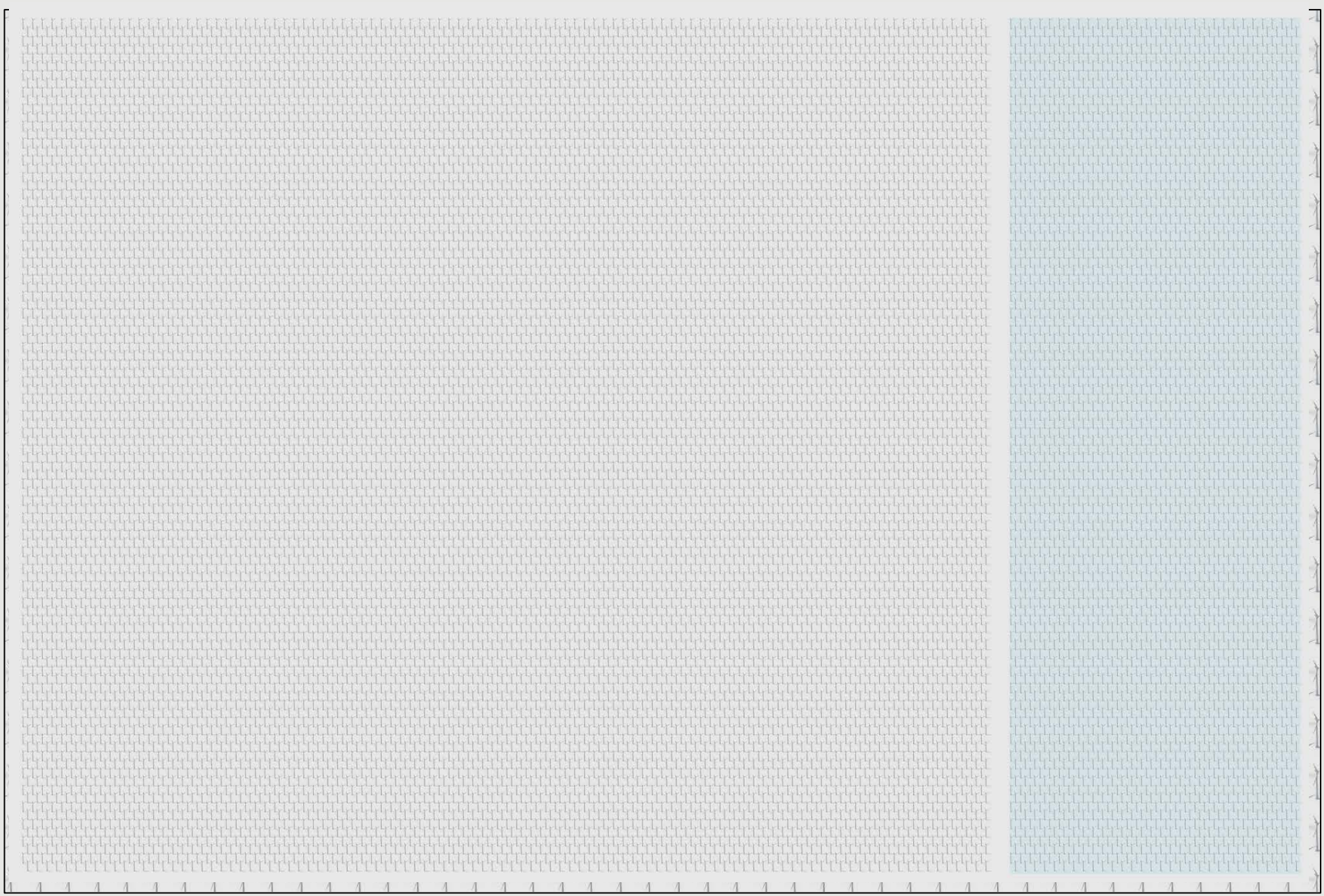
Historical & projected wind generation

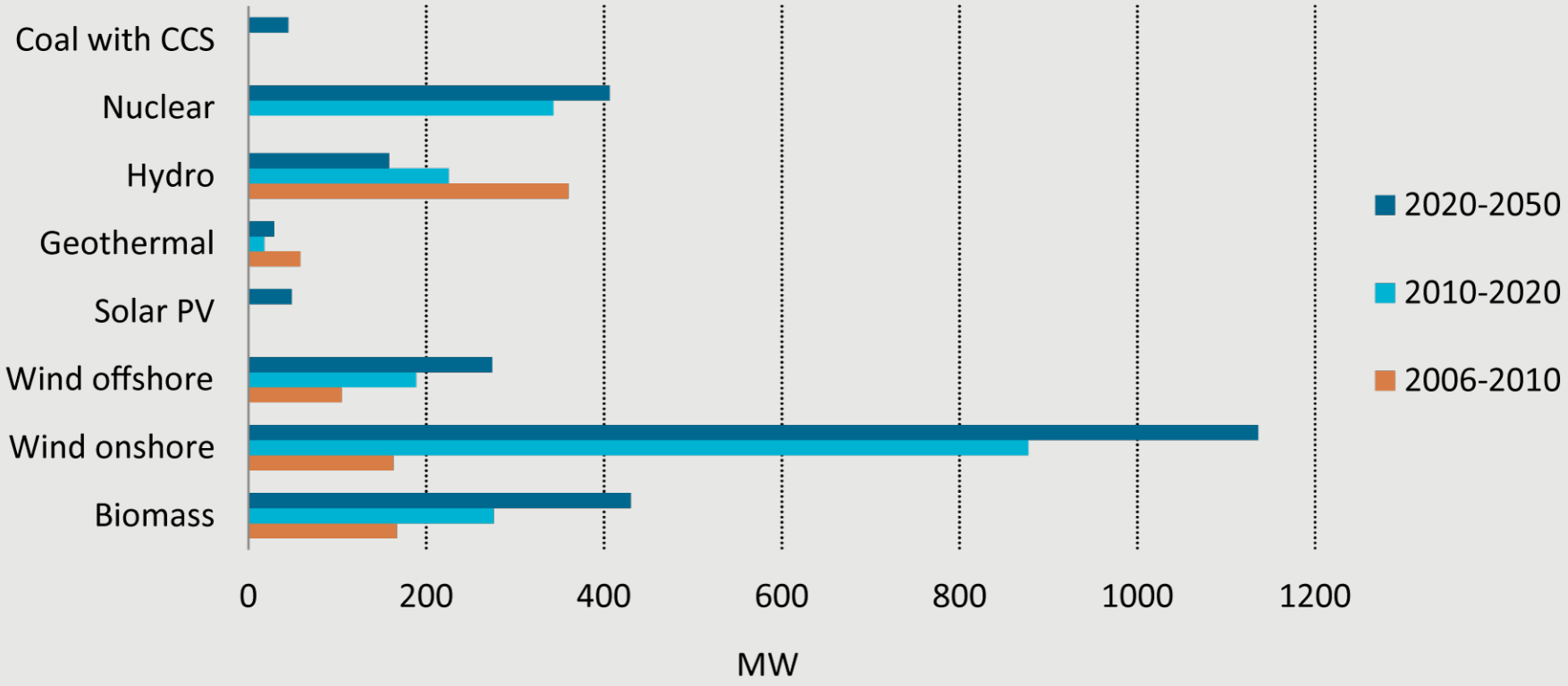


Historical & projected wind generation

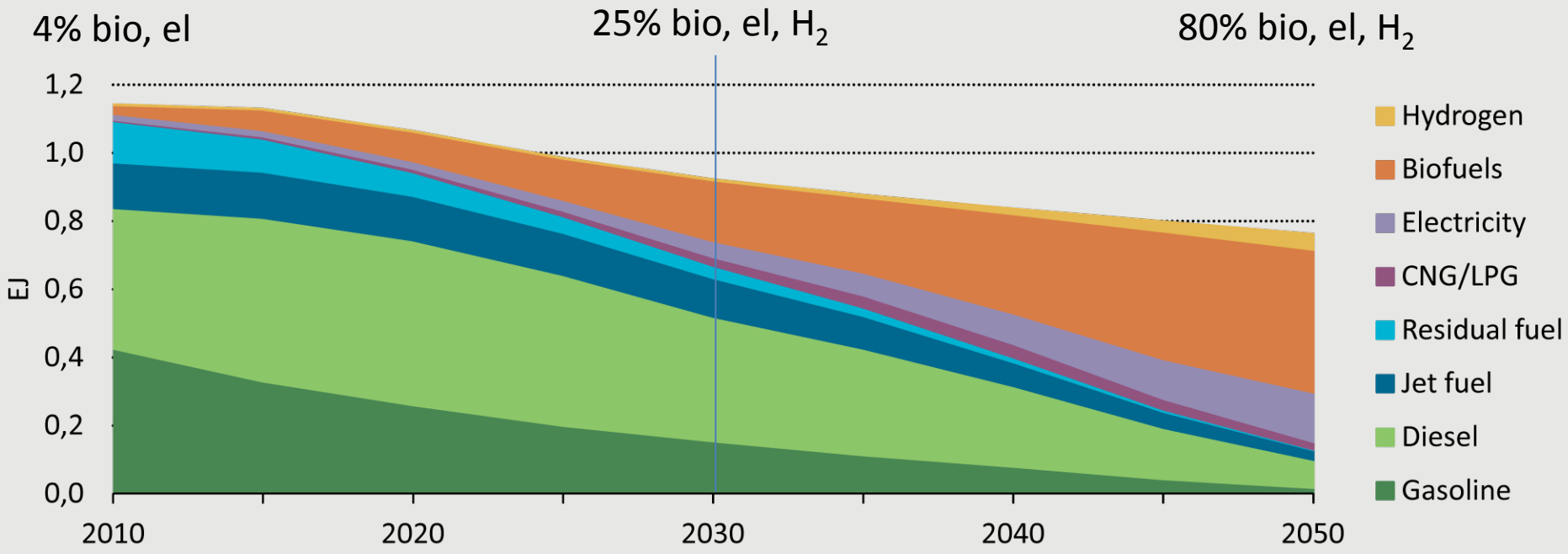




Annual new capacity additions in the Carbon-Neutral Scenario



Nordic energy use in transport



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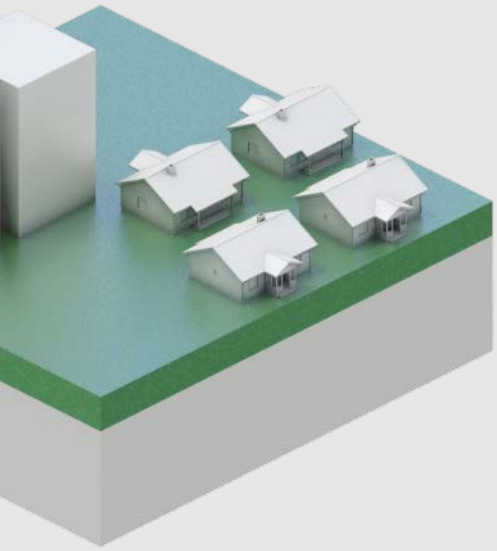
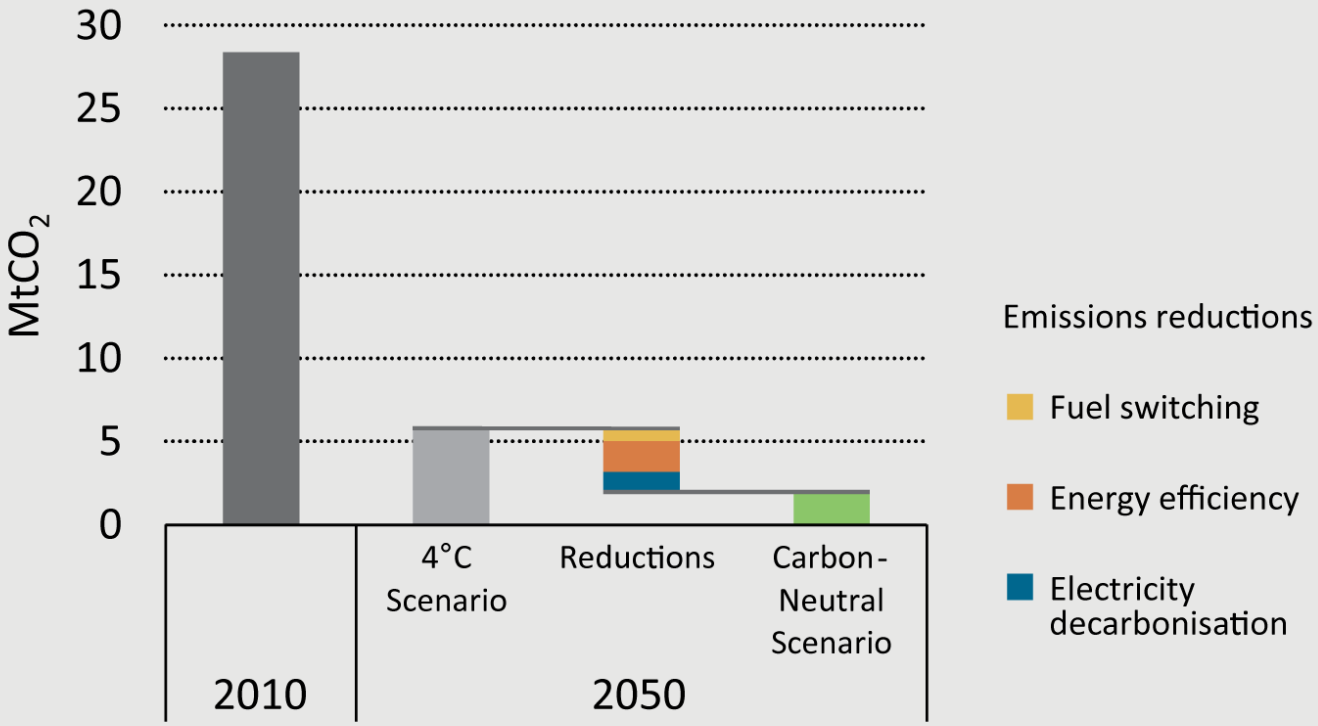
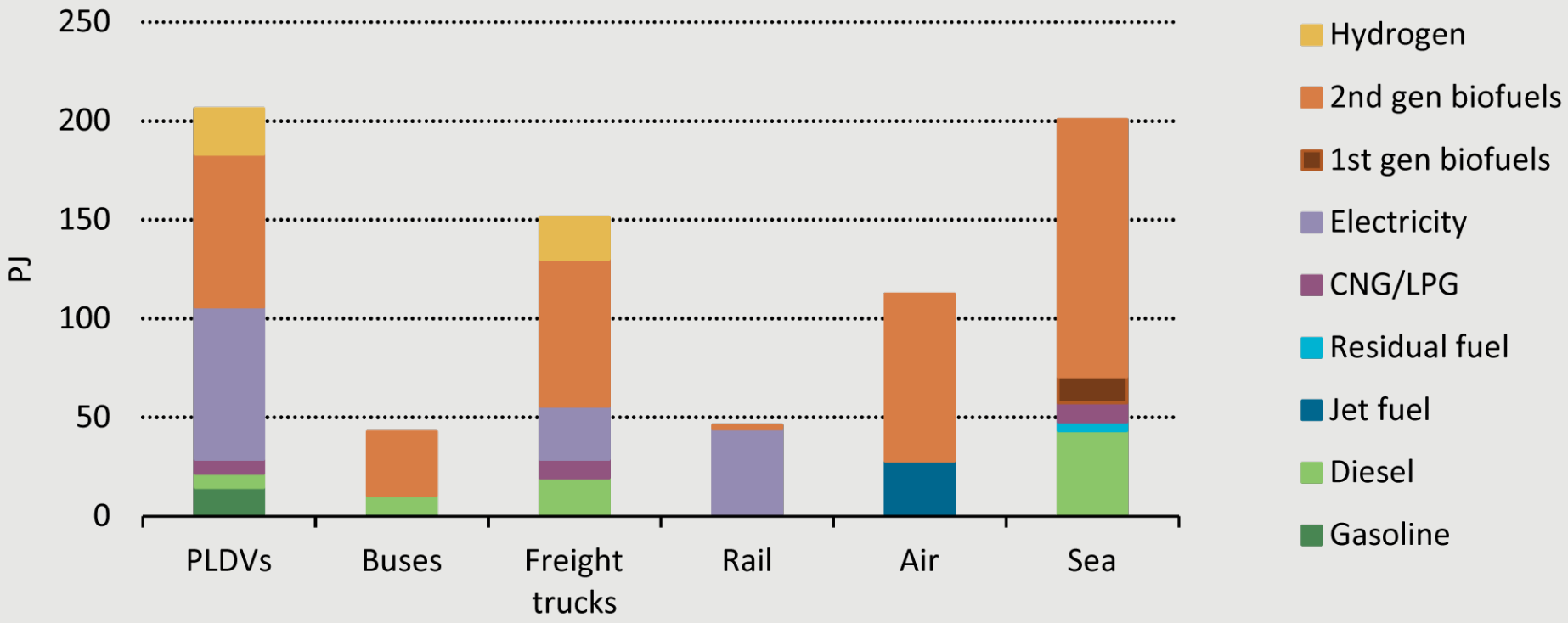
Nordic CO_2 emissions from residential buildings



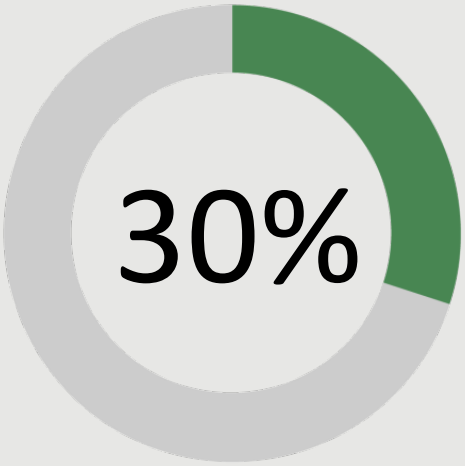


2050 energy use in transport

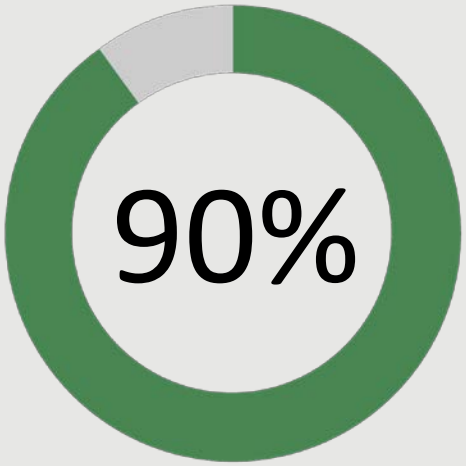


EV share of total Nordic car sales

70-80%
RE based

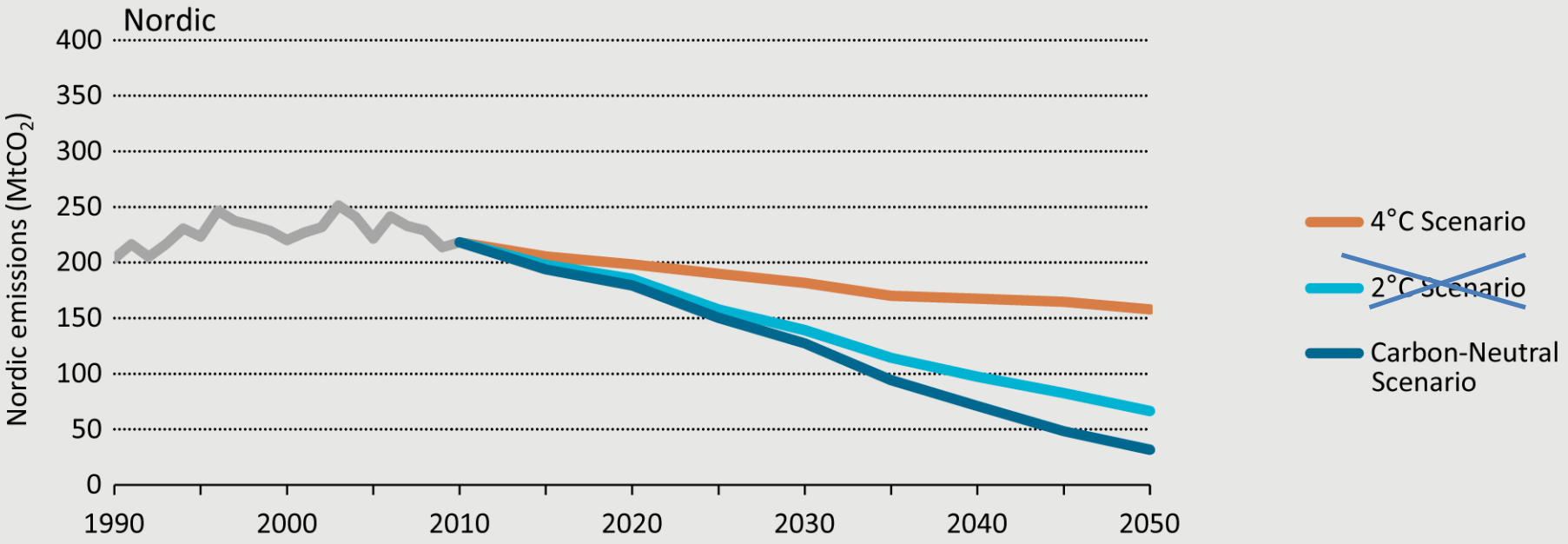


in 2030



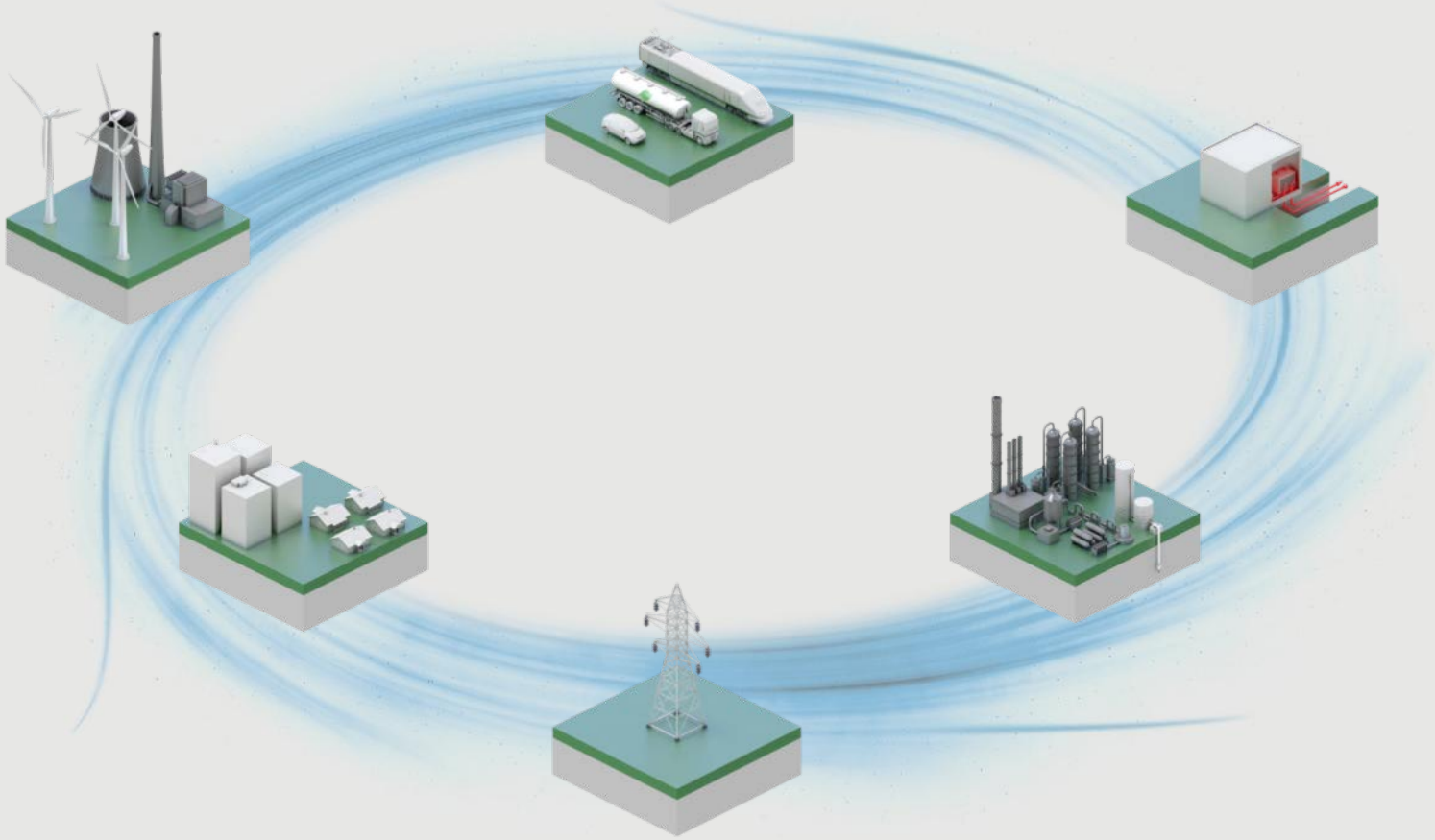
in 2050

NETP 2016: Scenarios



- Carbon-neutral scenario (CNS): 85% reduction of (energy- and process related) CO2 emissions by 2050 relative to 1990
- Carbon-neutral scenario (CNS) as central scenario with rest of the world following a 2 degree pathway (= global 2DS for ETP 2016)
- No 2DS for Nordic region

System integration



Example: Economic and climate effects of increased integration of the Nordic and German electricity systems

Hourly modelling:

Ex. Germany